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OBSERVATIONS ON YOUNG HUMMING-BIRDS.

BY H. S. GREENOUGH.

DURING the month of June last, I heard through friends of the nest of a humming-bird (*Trochilus colubris*) at Cotuit, on Cape Cod, where I was then staying, and having long wished for such an opportunity, I immediately decided to do what I could towards observing the growth of the young. Unfortunately the position of the nest made this rather difficult, for it was on a small dead branch of a yellow pine tree, some distance from the trunk and twelve to fourteen feet from the ground, or thereabout. Of four nests that I have seen, all in Cotuit, three were in yellow pines and one on a silver poplar, two about twenty or twenty-five feet high, one nine or ten and the last as above stated; the one on the poplar was on a small dead branch; with regard to those that were highest up, I do not remember whether they were on dead limbs or not.

The young birds were first seen by me on a Saturday, the previous Wednesday a lad, whom I sent up the tree, reported two eggs, as he had already done once before, so that I cannot say when the birds were hatched, and had feared to make daily visits at this stage lest I should frighten away the old bird. By means of a long step-ladder, improvised for the occasion by tying together two ordinary ladders, I was enabled to view the young within a few inches. Though very small, they were rather larger than I had expected them, and appeared to be already covered for

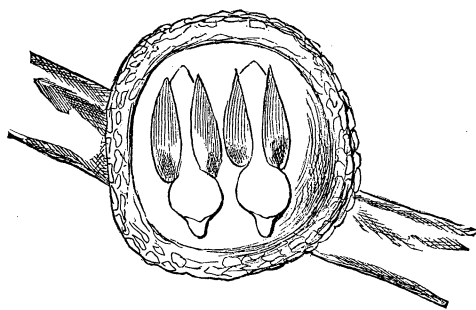


FIG. 1.—Diagrammatic sketch from memory of young when first seen. A trifle reduced; heads too small in proportion to bodies.

the most part, a bare streak extending, however, down the middle of the back; the bills were very short and of wide gape and yellow, and the general appearance of head and bill was decidedly swift-like, but whether the bill was of the full fissirostral type, *i. e.*, gape extending to

below the eye, I am not sure. I feared to take the young out for

closer inspection lest I should injure them or frighten off the old bird, and I particularly wished to ascertain other points which could only be done by leaving the nest undisturbed. The two young lay quite still at the bottom of the nest (which was deeper than those I have seen after the birds have left, and with sides and edge beautifully finished) with their heads pointing the same way and their bills somewhat upward and against the side of the nest. The annexed diagram, from memory, will give a fair idea of their general appearance at this time, it being borne in mind that special attention was paid to the head and bill.

On the following Thursday I again went up to the nest, and found the birds somewhat grown and the typical humming-bird bill beginning to show itself. I can best describe it by saying that it looked somewhat as if it had grown out of or on to the other like an extraneous thing, but was still only a fraction of an inch long, say a quarter or trifle less. During this time the old bird had been on the nest nearly always when I passed by, or if away was very soon back. A few days later, however, I found her absent for some time, at different hours of the day, and feared some accident had happened, but on watching near by I finally saw her return and feed the young and then sit on the nest again. I now borrowed an opera-glass and passed a good deal of time watching the feeding of the young. When first seen the old bird perched on the edge of the nest in an erect attitude, very much as a woodpecker on the trunk of a tree, and bent down her bill close to her nest whilst feeding the young; later on the position was varied, sometimes sitting nearly horizontal and feeding a bird on the opposite side of the nest. After the young got a little larger she could be seen to thrust her bill into theirs; she fed first one and then the other, apparently by regurgitation from the crop, for a motion could be seen in the region of the throat, and after feeding one she would hold up her head for an instant before feeding the other. In a few days she ceased to brood the young, but fed them very frequently. I often saw her fly to the nest, and when she had gotten near she would generally poise and look round before perching on its edge. On going away she would sometimes fly off immediately till out of sight, at others would alight some twenty to forty yards off and stay for



FIG. 2.—Diagram of young humming-bird's head on Thursday, *i. e.*, sixth day it was seen. From memory.

a few minutes, and then away as before. She did not appear to mind my presence much, if at all, though I was quite near, within thirty feet and sometimes much less, say fifteen or seventeen, *i. e.*, almost directly under the nest. At no time did I see the male bird come about the nest. Some ten days or thereabout after the young were first seen, their bills began to show above the edge of the nest, and soon after were generally plainly visible.

On the morning of the fifteenth day after the birds were first seen, one of them was observed to flutter its wings just a little for the first time. I now judged that the birds would soon leave, and accordingly passed several hours every day under the nest.

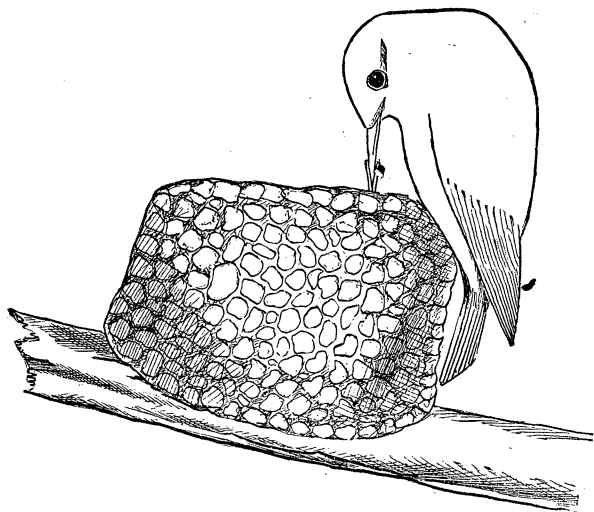


FIG. 3.—Humming-bird feeding its young; copied from pencil drawing made on the spot in summer of 1885.

The restlessness of the young increased; their heads generally showed above the edge of the nest, they looked about and frequently turned round, and every now and then one would flutter its wings, or sometimes only spread one or both; this phase was very interesting to observe on account of the progressive activity shown, and that without leaving the nest at all. By the following Wednesday the restlessness had increased very much, the birds raising themselves somewhat and the motion of the wings being very rapid, producing a gauzy, halo-like appearance as in old birds. The following morning, Thursday, *i. e.*, the twentieth day,

I saw one of them raise himself on "tip-toe" and, fluttering his wings, get upon the edge of the nest and then down upon the branch, sit there a moment, and then back into the nest in the same way. I watched all the morning, but neither bird left the nest, though both seemed very restless; on my return in the afternoon only one young bird remained. I saw the old one feed him once or twice, and noticed that she approached him from a different direction to what I had before seen, coming downwards from the clump of pines, on the edge of which stood the nesting tree, instead of the open glades from which I had always before seen her approach. I accordingly laid on my back and looked upward, and presently saw her return and perch on a bough beside another humming-bird, feed it and fly away. I now watched the bird on the bough very carefully and soon saw it fly, and this it did repeatedly at short intervals, sometimes down, again up, on a level and in curves; except for the shortness of its flights, I could see no difference from that of the old bird (and as it was well grown, had I seen it casually I should not have known it for a young one); there appeared to be the same precision of movement, facility of turning and rising, and the same humming style of flight, though I was not near enough to hear any sound. Once toward the end of an unusually long flight, I thought, I perceived signs of fatigue, but do not feel sure of this. The second bird continued in the nest, and was still there on Friday morning and again in the afternoon, the other bird being in the neighboring trees, flying perfectly, and both frequently fed by the old one. On Saturday morning the second bird had also left, and all three birds, if I remember rightly, were observed in and about the neighboring trees. I now tried to get some pots of flowering plants to place near by, and determine, if possible, how soon the young would begin to feed themselves, but did not succeed in obtaining any, so that I could not ascertain this point.

I frequently heard a faint chirping just before or during feeding, but do not know if made by old or young, or both, though, as when feeding the flown bird, I once saw the old one seek him some little time, he having changed his place, and heard the chirping. I am in this case inclined to think the young bird must have made the sound, and perhaps the old one also.

I once saw the old bird thrust her tongue out, and to a much greater distance than I should have supposed.

I was unable to secure any photographs, though a friend kindly tried to take some for me, our ladder proving too short to admit of getting the camera into position for focussing ; but the rough drawing made on the spot with the aid of an opera-glass may give a better idea of the feeding position assumed by the mother bird than my description has done.

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THE MECHANICS OF SOARING.

BY PROFESSOR J. E. HENDRICKS.

AS Mr. I. Lancaster has published, through the medium of the AMERICAN NATURALIST, his very interesting and valuable observations of soaring birds, and has, in the April number (No. 4, Vol. xx) given an explanation of the mechanics of soaring that might lead non-technical readers astray, a brief review of the "Mechanics of Soaring" may not be unprofitable to some of the readers of the NATURALIST.

As much that Mr. Lancaster has said is in accordance with the recognized principles of mechanics, I will not encumber the pages of the NATURALIST with a general review of the whole article, but will confine this paper mainly to a consideration of the question proposed by him and which he regards as a crucial test of the validity of his theory of soaring.

In investigations concerning the operation of forces, it is important that the distinction between continuous and momentary forces be kept in view. Although all forces require time for their operation, yet such forces as act for a short time and then cease to act, are called *momentary* forces, and the time during which they act is not considered ; the velocity induced being constant and equal to the intensity of the force divided by the mass.

When a force acts uniformly for a considerable portion of time, it is called a *constant* force, and the time of its action is involved in the velocity it induces, which is represented by the intensity of the force multiplied by the time and divided by the mass or weight of the body.

Although we do not know what produces the phenomena of gravitation, we know, as manifested on the surface of the earth, it is a result of two opposing forces (a centripetal and a centrifugal force) whose difference at any point on the earth's